USER-MANUAL
TC16-40-58

Tamson Instruments B.V.

P.M. Tamson Instruments bv
van 't Hoffstraat 12
2665 JL Bleiswijk
THE NETHERLANDS

T. 31 (0) 10 522 43 73
F. 31 (0) 10 521 19 41
www.tamson.com
info@tamson.com

VAT: NL 80 66 34 984 B01
Bank account no.: Rabobank 16 01 00 046
Chamber of commerce 27 16 95 41
IBAN Code: NL95 RABO 0160100046

CONTENTS

1 SAFETY AND WARNINGS 3
2 WARRANTY 3
3 EC declaration of conformity 4
4 Precautions and hazards 5
5 INSTALLATION 5
5.1 UNPACKING 5
5.2 INITIAL USE 6
5.3 FILLING THE BATH 6
6 CONNECTING 7
7 Introduction to the TC series 8
7.1 GENERAL 8
7.2 PUMP 8
7.3 COOLING 8
7.4 OVER TEMPERATURE SAFETY 9
7.5 ADJUSTING THE MECHANICAL OVER-TEMPERATURE PROTECTION THERMOSTAT 9
8 Operation 10
8.1 SWITCHING ON 10
8.2 CONTROL PANEL 10
8.3 BACKSIDE OF THE THERMOSTATIC BATH 11
8.4 SELECTING PARAMETERS 11
8.5 QUICK START, ADJUST SET POINT 13
8.6 TUNING THE BATH 13
8.7 TUNE PID VALUES 14
8.8 DESELECT TUNING 14
8.9 MANUAL TUNING 14
8.10 DRAINING BATH FLUID 15
8.11 USING THE DRAIN TAP (OPTIONAL) 15
8.12 FAST METHOD: DRAIN BY HAND 16
8.13 MAINTENANCE 16
9 TROUBLE SHOOTING 17
9.1 GENERAL 17
9.2 MESSAGE ON DISPLAY 18
10 SPECIFICATION 18
10.1 TECHNICAL SPECIFICATIONS OVERVIEW 18
11 Spare parts 19
12 DISCLAIMER 19

1 SAFETY AND WARNINGS

Make sure before installing or operating the equipment to read and understand all instructions and safety precautions listed in this manual. If there are any questions concerning the operation of the equipment or about the information given in this manual please contact your local dealer or our sales department first.

Performance of installation, operation, or maintenance other than those described in this manual may result in a hazardous situation and may void the manufactures warranty.

Never operate equipment that is not correctly installed. Unqualified personnel must not operate the equipment. Avoid damage to the equipment, or its accessories, caused by incorrect operation.

Important:
- When performing service, maintenance or moving the apparatus, always disconnect the line cord of the apparatus,
- Proper skilled and trained personnel are only allowed to operate this equipment,
- Take notice of warning labels and never remove them,
- Refer service and repairs to qualified technician,
- If a problem persists, call your supplier or Tamson Instruments B.V..

2 WARRANTY

Tamson Instruments B.V. warrants that all their manufactured equipment is free from defects in material and workmanship, preventing the machine from normal operation. Tamson Instruments B.V. does not warranty that the equipment is fit for any other use than stated in this manual. The manufacturer can only be held responsible for the security, reliability and performance of the equipment, when operated in accordance with the operating instructions, extensions, adjustments, changes and/or if repair is performed by Tamson Instruments B.V. or authorized persons only. This warranty is limited to one year from the date of invoicing. All equipment and materials are subject to standard production tolerances and variations.

3 EC DECLARATION OF CONFORMITY

Manufacturer: Tamson Instruments bv
van 't Hoffstraat 12
2665 JL Bleiswijk
The Netherlands

Product: Thermostatic bath and circulator
Model: TC16 / TC40 / TC58

The products to which this statement relates, is manufactured and dully carried out in compliance with the provisions of directive 73/23/EEC on the approximation of the laws of the member states relating to low voltage.

The products are in conformity with the following specifications:

Item	Reference	Description	Test result
1	**EN55016-2-1**	Conducted emission	p
2	**EN61326+A1**	Conducted discontinuous emission	p
3	**EN55016-2-3**	Radiated emission	p (anechoic room)
4	**EN61326+A1+A2+A3**	Radiated emission	p (anechoic room)
5	**EN61000-3-2**	Harmonics	p
6	**EN61326 +A1+A2+A3**	Flicker	p^3
7	**EN61000-4-2 +A1+A2**	ESD	p
8	**EN61000-4-3 +A1**	Radiated immunity	p
9	**EN61000-4-4+A1+A2**	Electrical Fast Transients	Minimum requirements pass
10	**EN61000-4-5+A1**	Surges	Minimum requirements pass
10	**EN61000-4-6+A1**	Conducted immunity	p
11	**EN61000-4-11 +A1**	Voltage dips and Voltage variations	p

p = Pass
p^3 = Pass, condition of operating during Pst measurement: Operational with heating element 1500W. P_{st} and P_{lt} are not evaluated in accordance with A.5 of Annex A of EN 61000-3-3(1995) + A1(2001).

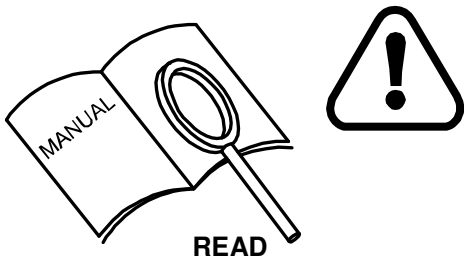
not applicable were:
Conducted discontinuous emissions (Clicks)
Radiated emission (OATS)
Power Frequency Magnetic Field*

2007, Tamson Instruments bv, The Netherlands,

Name : R.C. van Hall
Function : Director

4 PRECAUTIONS AND HAZARDS

Before attempting to operate the bath read all parts of this manual carefully to insure smooth operation and avoid damage to the equipment or its accessories.



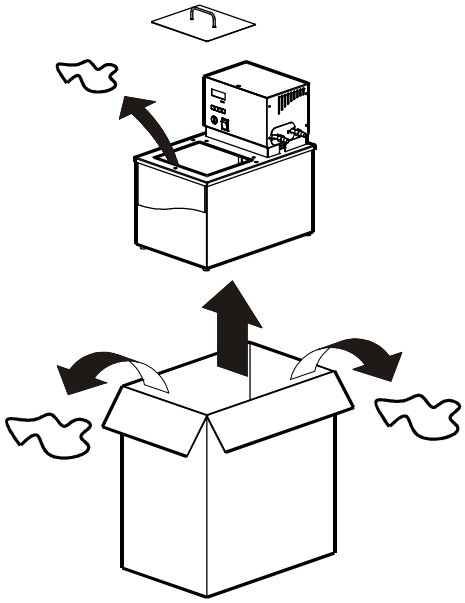
READ CAREFULLY

If a malfunction occurs, consult section "TROUBLE SHOOTING", page 17.
If a problem persists, call your supplier or Tamson Instruments B.V. Never operate the equipment if not correctly installed. The equipment must be operated only by qualified personnel. Avoid damage to the equipment or its accessories through incorrect operation.

5 INSTALLATION

Tamson Instruments B.V. is not responsible for any consequential damage or harm caused by using this bath. Repairs on the electrical system of the bath may only be carried out by well trained and authorized persons.

5.1 Unpacking



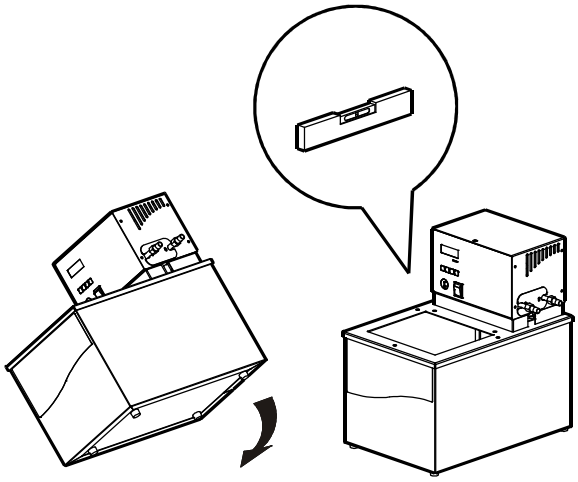
To avoid damage during transport all Tamson baths are carefully packed for shipment. Check the packaging for external damage and make a note on the shipping documents if any damage is found. Always retain the cartons and packing material until the bath has been tested and found in good condition. Transport companies generally will not honor a claim for damages if the respective box is not available for examination. The shipment contains at least the bath/circulator. The consignment may contain other parts, individually packed in small boxes. Please see packing list for details concerning total contents of consignment.

Before filling the bath remove any remaining packing material from its interior. The interior of the bath can be accessed by taking off the lid on the top of the bath.

Unpack the apparatus with care. Do not use sharp tools for unpacking, these can damage the bath. Keep the packaging until you're fully assured that the apparatus is functioning properly. In case of return of the apparatus, we will only accept original packaging.

5.2 Initial use

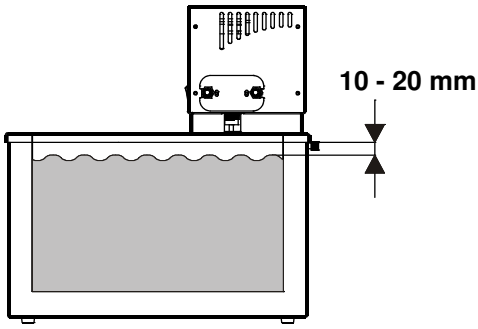
Before filling the bath make sure that the bath is clean. Place the bath spirit level, and connect it to the mains after the mains-switch is placed in “off” position. Use a mains-supply with proper grounding.

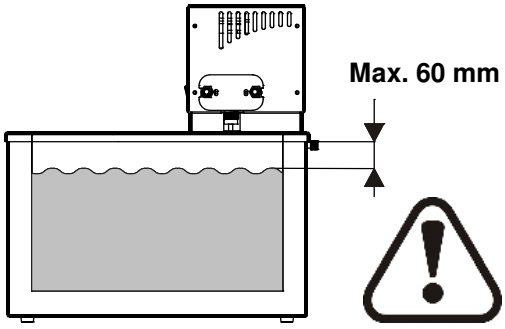


Important: Never use the bath without fluid

5.3 Filling the bath

The bath-fluid level must be 10- tot 20 mm below the edge of the top-plate.

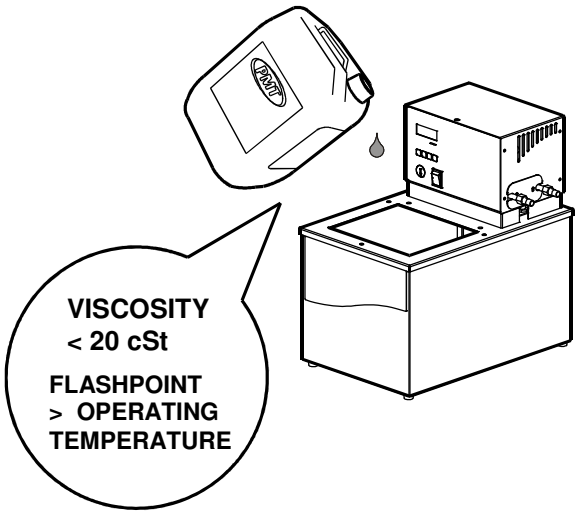




In **no case** the fluid level may be **lower than 60 mm** under the edge. This can cause severe damage to the heating element.

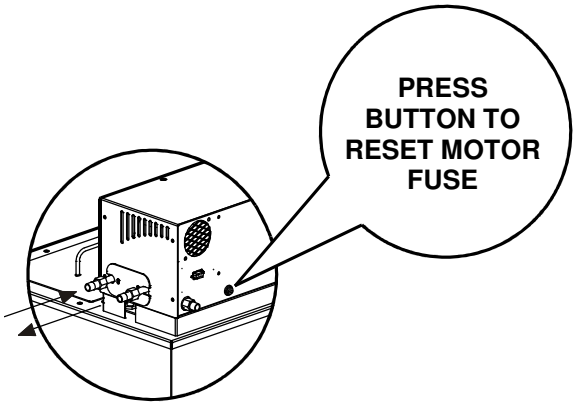
For working temperatures above +80°C a fluid with a high boiling point must be used. The bath fluid also has to be chemically stable and must have low viscosity preventing damage to the pump. Tamson oil type 150 has these characteristics and is recommended to use for temperature ranges which lie between +80°C and +150°C.

Silicon oil can be used for temperatures higher than 80°C.



It is very important to select a liquid with a viscosity of less than 20 cSt at the operating temperature and a flash point which is well above the operating temperature.

When viscosity of the bath fluid is too high at room temperature, the motor-fuse will be activated. In such a case the bath fluid can first be heated to set point temperature. When the bath has reached it's set point the motor fuse can be reset by pressing it. This way of operating will reduce the life of the motor and is thus **not recommended.**

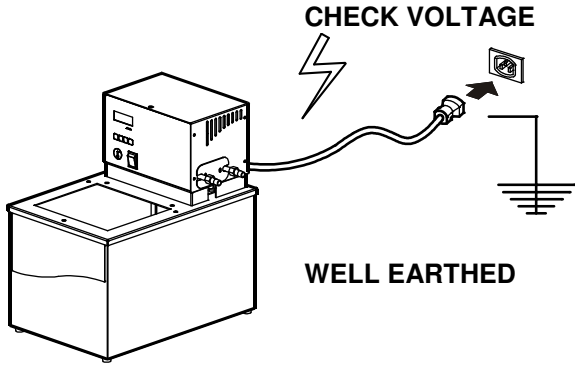


Type	Remarks	Life			Viscosity [cSt] x				Temp. Range	Package	Ordering code
		150°C	200°C	250°C	80°C	100°C	150°C	200°C			
Mineral	T150 Yellow Mineral oil	1/2 yr	X	X	20	7	3		80..150°C	20 ltrs	00T0220
Silicon	200 -10 Transparent Dimethyl siloxane polymer	No limit	200hrs	<10hrs	4	3.5	2.5		20..150°C	20 ltrs	08T0001
Silicon	200 -50 Transparent Dimethyl siloxane polymer	No limit	200hrs	<10hrs	20	15	9		80..150°C	20 ltrs	00T0226
Silicon	Silicon 210 Dark Dimethyl poly siloxane	No limit	<2yrs	<1yr	(35)	30	22	12	80..250°C	20 ltrs	00T0231
Silicon	Silicon 550 Colorless Polyphenyl methyl dimethyl siloxane	No limit	<1yr	<1200 hrs	(50)	20	12	5	80..250°C	20 ltrs	00T0238

Do not use demineralized water. This water can lead to corrosion of the bath and moving parts. The corrosion can wear out the pump bearings

6 CONNECTING

Before plugging TC 16, TC40 or TC58 into the mains socket, make sure the voltage of the bath corresponds to the local voltage and frequency.



Use a mains supply that is well earthed, clean of interference and suitable for the acquired electrical load of the bath.

7 INTRODUCTION TO THE TC SERIES

The TAMSON model TC baths are used for precise temperature control. This series offers a choice in relatively large bath volumes.

7.1 General

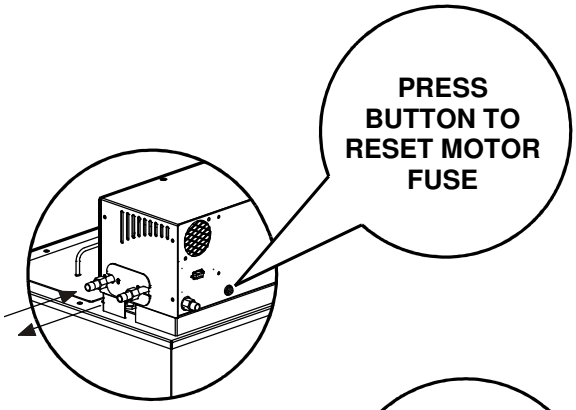
The TAMSON baths are constructed throughout from corrosion-resistant – stainless steel and Teflon – materials. Outher casing is zinc plated powder coated steel. The bath is effectively insulated against heat loss by a layer of Armaflex® rubber between the inner tank and outer casing.

7.2 Pump

A circulation pump is built-in to guarantee an uniform temperature distribution within the bath and providing the possibility to circulate through a closed external system.

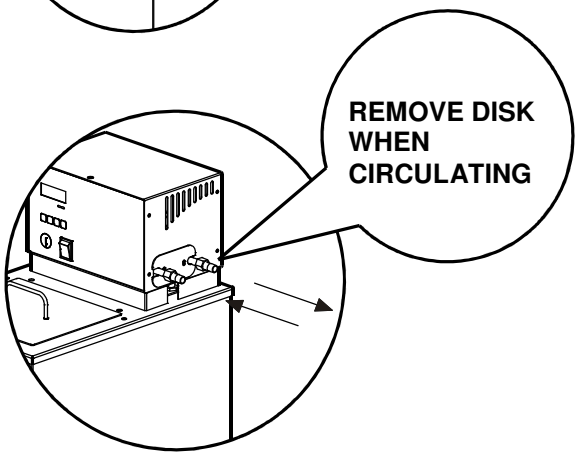
The standard pump offers a motor protection (small thermal fuse) which is placed on the back panel of the motor compartment. This protects the motor from excessive loads.

When pumping viscous liquids the thermal fuse can be activated. The motor fuse can be reset by pressing the button.



The inlet and outlet of the pump are fitted with 8 mm hose connections and 1/4” threaded fittings for metal tubing. The outlet is provided with a small disc, stopping the circulation action.

Before the fluid can begin circulating through external systems this disc must be removed by unscrewing the fitting and hose connection removing the disc.



7.3 Cooling

The TC-bath is equiped with a cooling coil. Circulation of fluid, with a lower temperature than the bath fluid, through this coil will cool down the bath temperature. To get stable control of the bath when using the cooling coil, the temperature of the cooling fluid has to be approximately 5°C lower than the set point temperature of the bath. Cooling is need for set point temperatures of approximately 42°C and lower.

The cause for this relatively high temperature is the self heating of the bath due to friction of the pump. The insulation of the bath prevents this energy to be transferred into the environment. This causes a raise of temperature in the bath up to 25 .. 30°C depending on the environmental temperature and used bath fluid.

For cooling the bath down to lower temperatures, tap-water is mostly used. Also a small circulator can be connected to the cooling coil like the Tamson TLC10-3, or TLC15.

7.4 Over temperature safety

In case of electronic failure the possibility exists that the heater element is continuously switched on. This will cause extreme temperature raise. To prevent high temperatures the bath is fitted with a mechanical temperature switch(thermostat). This thermostat will switch-off the bath at a preset temperature in the range from 50 tot 270°C.

We advise to adjust the mechanical over temperature to approximately + 25°C above the bath set point.

This safety construction prevents for example oil to be heated above flaming-point which defenately will cause fire or prevent evaporation of bath fluid due to high temperatures.

The thermostat will automatically reset when the bath temperature drops approximately 10°C below the pre-set temperature. To continue normal operation the bath has to be switched off and on again.

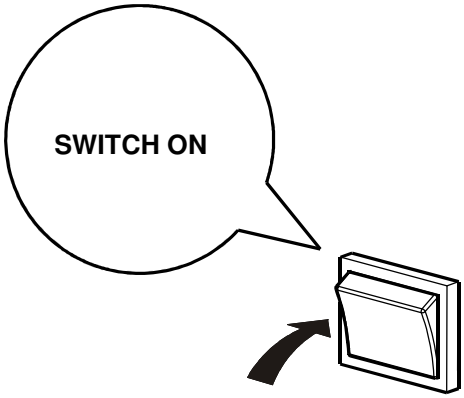
7.5 Adjusting the mechanical over-temperature protection thermostat

- Turn the over-temperature protection(2, drawing 1) to its maximum (turn clockwise towards 50°C),
- Heat the bath to it's set point,
- Gently turn the over-temperature protection anti-clockwise, until the over-temperature protection is activated, and system switches off,
- Turn the over-temperature protection approximately 25°C higher (turn clockwise),
  Switch the bath off and on again. The bath is ready to operate safely.

8 OPERATION

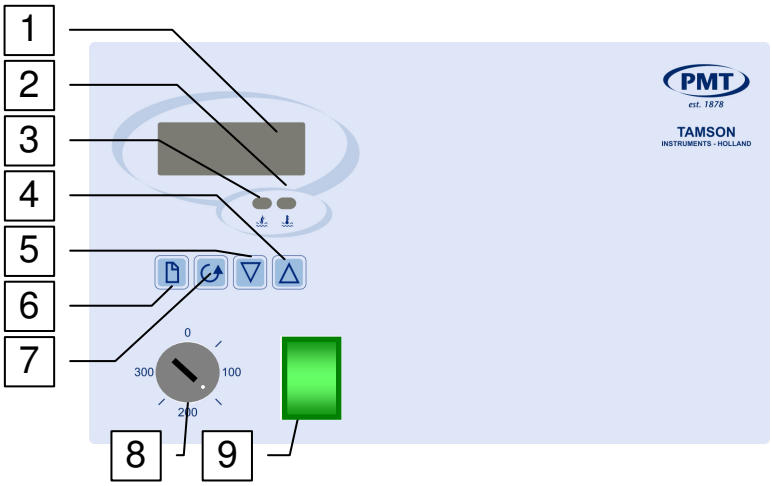
8.1 Switching on

If the bath has been properly filled with fluid it can be switched with the mains switch located on the front panel. Choose a working temperature (set point).

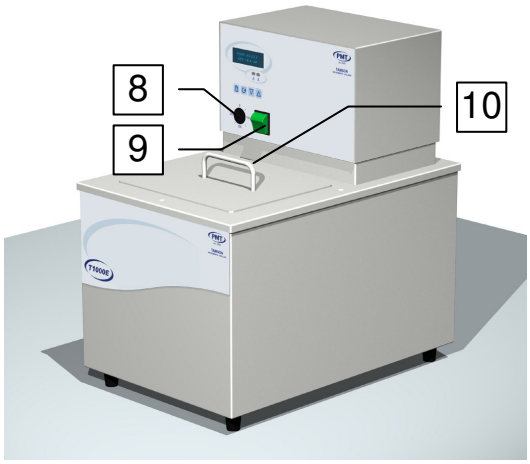


8.2 Control Panel

1. LED Display
2. LED Over-temperature*
3. LED Heater
4. Up - key
5. Down – key
6. Page – key
7. Scroll - key
8. Safety thermostat
9. Mains On/Off
10. Top lid



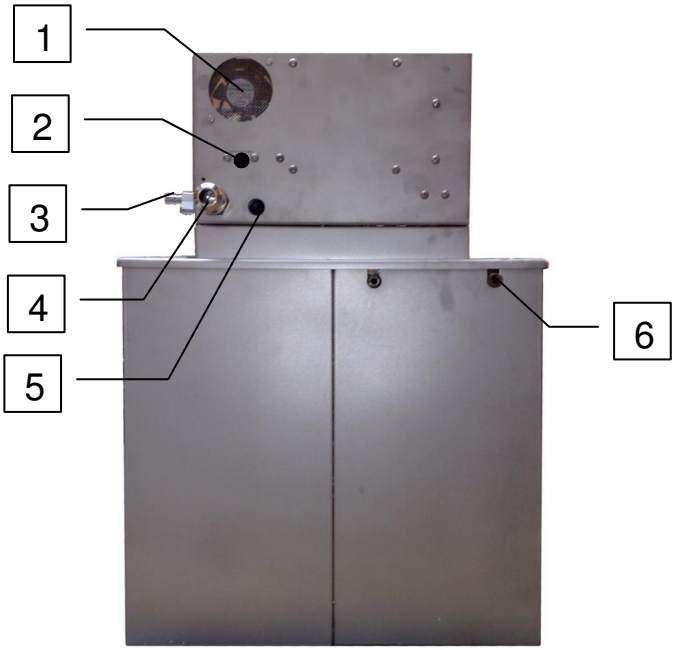
* When the overtemperature safety is activated
wait until the bath temperature is lowered several degrees. The safety thermostat will reset itself. Turn the bath off and on again. The bath will continue operation.



8.3 Backside of the thermostatic bath

1 Cooling fan
2 RS 232 Communication
3 In and outlet pump
side view connection:

4 Mains cable
5 Motor fuse
6 Cooling coil, 1/4" outher thread



8.4 Selecting parameters

The front panel layout shows the following 4 operating keys:

PAGE
LIST
DOWN
UP

Press shortly and following is displayed

SP.1 - Temperature set point in °C,
tU.n - Tuning the bath (“Atune”),
Pb - Changing the tuning (PID) parameters "P"value
ti - Changing the tuning (PID) parameters "P"value
td - Changing the tuning (PID) parameters "P"value
OFSt - Change temperature readout offset (± 5°C)

Sequence

Each time is pressed another option is displayed.

Up and Down keys allow changing the listed value. All changed values, like set point and PID parameters, will be kept in memory when pressing the page key to leave the menu. After switching off the power supply, changed values are kept in memory.

SP.1 - Set point adjust. Press page key to confirm setting when altered.

tU.n - Auto tuning PID parameters, set on or off.
Off is default value here.
On, when selecting parameter 2nd time, On.A is played. This indicates adaptive tune. Bath is adapting PID setting in background operation. When in On.A mode PID values can not be set manually anymore.

pb - Changing the tuning (PID) parameters. 'Proportional band value. Default value is 2, range 1 .. 100. (Proportional band equals 1/proportional value). Press page key to confirm setting when altered.

ti - Changing the tuning (PID) parameters 'Integrator' value. Default value is 200. Range 1 .. 1200. Default value is 200. Press page key to confirm setting when altered.

td - Changing the tuning (PID) parameters 'Differentiator' value. Default value is 10. Range 1 .. 600. Default value is 40. Press page key to confirm setting when altered.

OFST - Set offset. The offset value is added to the displayed bath temperature. I.e. when the displayed bath temperature is 20.0°C, an offset of 0.2 displays a value of 20.2°C. An offset of -0.2°C will display 19.8°C. Range is -5°C .. +5°C. Press page key to confirm setting when altered.

note:

☞ When tune is set to on, PID values can not be set. Change tune to off en alter PID values.

☞ Press page key to confirm setting when altered.

8.5 Quick start, adjust set point

To quickly start operating the bath:

- Fill the bath with sufficient and appropriate fluid. see Filling the bath.
- Place the power plug,
- Switch on the bath using the mains switch,
- Choose a working temperature (set point):

Press [ ] once. Display will indicate "SP.1". Alter set point temperature by using up [▲] and down [▼] key to select the desired bath temperature.
Confirm by pressing [ ].

8.6 Tuning the bath

The temperature control of the bath is based on a digital PID system. When using different fluids in the bath each with their own heat capacity, the use of external cooling and external connected processes(circulation), or working at different set point temperatures requires new settings of the PID parameters. These parameters have to be optimized after changes to the system when optimal and accurate temperature control of the bath liquid is required.

IN-TUNE

Tuning of the bath results in:

- Stable temperature control of the bath,
- No over- or undershoot of the temperature set point,
- Quick response to deviations from the set point caused by external disturbances.

Tuning can be done automatically or manually. The parameters mentioned in Table 1 will influence the control of the bath.

Parameter	Description	Display
Proportional band	The bandwidth in display-units over which the output power is proportional between minimum and maximum	Pb
Integration time	Determines the time taken by the controller to remove steady state error signals	Ti
Derivative time	Determines the time taken by the controller to react on error signals.	Td

Table 1 Parameters influencing the temperature control

8.7 Tune PID values

Choose desired set point,
Wait until the bath has reached the set point temperature,
Highest temperature accuracy can be achieved when tuning the bath. Select tU.n by pressing twice.

Press ▲ to choose “ON”,

Press ▲ 5 times to return to displayed PV
(PID values can no longer be adjusted unless the "tU.n" value is set to off)

8.8 Deselect tuning

- Pressing twice,
- Display shows ”tU.n”,
- Press ▼ to choose “Off”,
- Press 5 times to return to displayed PV.

8.9 Manual tuning

The parameters for the PID control can also be changed manually. The method described below provides fast finding of the PID settings and is refereed to as the method of "Ziegler Nichols"

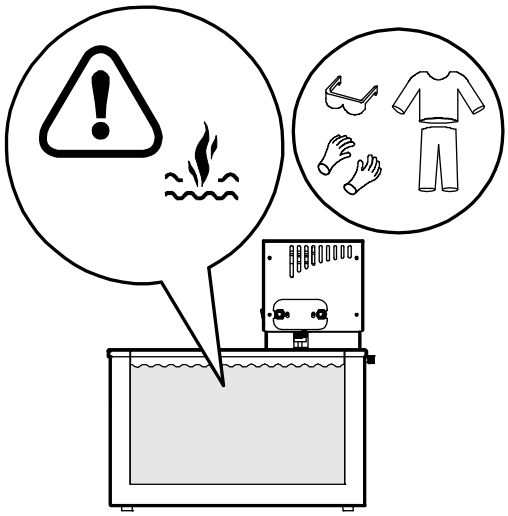
This procedure is only to be followed when automatic tuning is not functioning.

This method provides fast manual findings of the PID values. Start the bath at its required running temperature:

1. Set the integral time “Ti” and the derivative Time “Td” to off
2. Check if the Lcb and Hcb are set to auto
3. Ignore the fact that the temperature may not settle precisely at the set point
4. If the temperature is stable, reduce the proportional band Pb so that the temperature just starts to oscillate. If the temperature is already oscillating, increase the proportional band until it begins oscillating. Allow enough time between each adjustment for the loop to stabilize. Make a note of the proportional band value “B” and the period of oscillation “T” Set the Pb, Ti and Td parameter values according to the calculations given in the table below

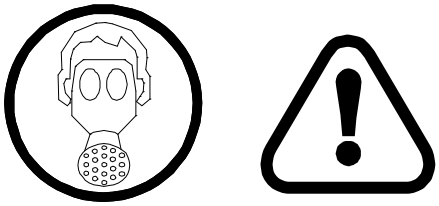
Type of control	Proportional band	Integral time "**ti**"	Derivative Time "**td**"
Proportional only	2xB	Off	Off
P + I control	2,2xB	0,8xT	Off
P + I + D control	1,7xB	0,5xT	0,12xT

8.10 Draining bath fluid



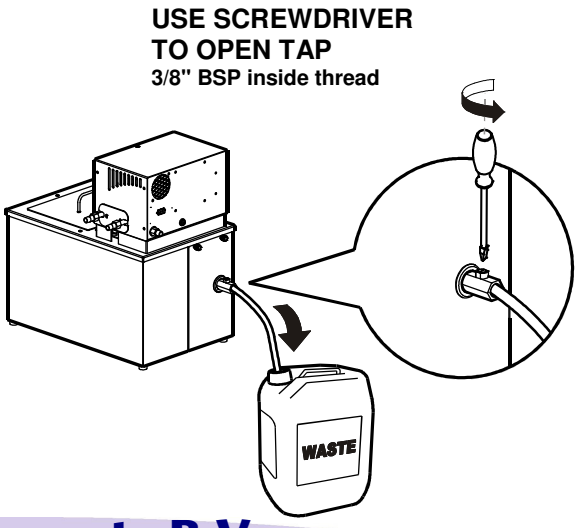
Before removing flammable bath liquids take the appropriate fire hazard precautions against these liquids.

When draining the bath fluid, be sure that the bath fluid has cooled down to ambient temperature. If viscosity is too high at ambient temperature to remove the fluid, make sure that the hose to drain and waste container can withstand the temperature of the bath fluid.



When removing bath fluid do not inhale toxic vapor. Always use appropriate ventilation.

8.11 Using the drain tap (optional)



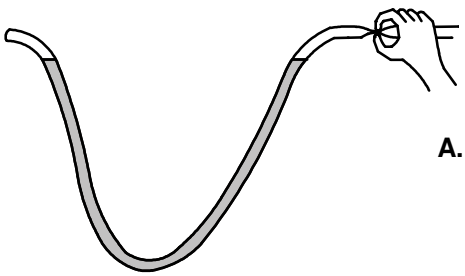
The TLC baths can be drained via the drain tap located at the backside of the apparatus.

The drain has an inner diameter of 3/8” gas fitting. The drain can be connected onto a pipe, tube or drainage system.

For safety reasons the tap can only be opened by using a screwdriver. The thread inside the tap is 3/8".

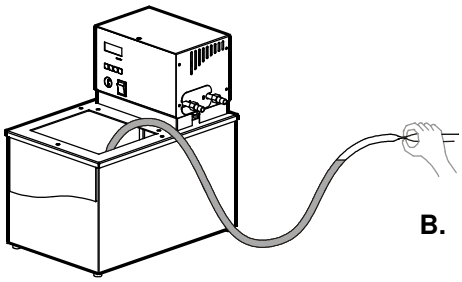
8.12 Fast method: drain by hand

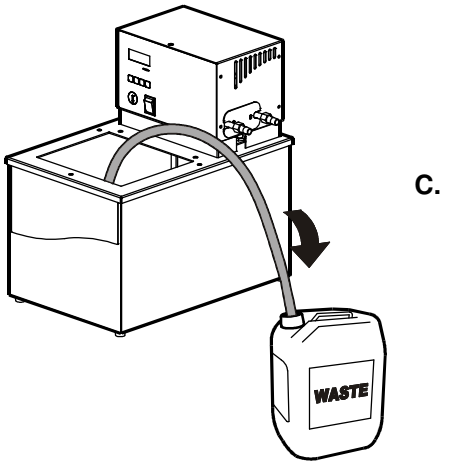
The bath fluid can easily be removed by using a length of hose. Length of approximately 1.5 mtr and 10mm inner diameter.



Handle as follows:
Fill the hose with fluid (“A”),

- Close one side of the hose and immerse the other end in the bath (“B”),
- Lower the closed end into a waste bucket and let the bath fluid flow (“C”),
- Remove the last pieces with a sponge or tissue,
- Refill the bath approximately 1 cm below the lid.





8.13 Maintenance

Keep the apparatus free from dust. Regularly check the cooling openings and remove dust with vacuum cleaner. If necessary remove cover and clean internally. Use appropriate protection when cleaning, dust can be very unhealthy.

9 TROUBLE SHOOTING

All Tamson products are well designed and carefully tested before shipping. This will not fully prevent small problems in the field. Following will help you to locate commonly known problems and how to fix them. In case of doubt please check your local dealer or Tamson Instruments bv.

9.1 General

Bath malfunction	
The motor is not running and electronics is dead.	Check mains and main fuse.
Motor is not turning:	Probably the motor fuse is activated. Restart the motor by pressing the motor fuse . Check viscosity of the bath fluid. High viscosity will activate the motor fuse. Electrical defect. Motor capacitor defective. Replace capacitor or contact local dealer or Tamson Instruments bv
Problems with set point	
Heater LED is not burning, motor is turning and temperature raises above set point:	Setpoint too near to room temperature. *Cooling of the bath is needed*
Temperature doesn't reach set point:	Bath fluid evaporates too quick. Use other fluid
Heater malfunctions:	Measure electric mains current. Current below 2 amps indicate a problem with the heating element.
Cooling capacity is too high.	Reduce cooling.
Temperature not stable:	Tune the bath at the set point temperature.
PID values	
Unable to set PID values:	Check if ATUN has been set to on. PID values can no longer be adjusted unless the ATUN value is set to off. **See** Fout! Verwijzingsbron niet gevonden. page **Fout! Bladwijzer niet gedefinieerd.**.
Faulty temperature readings	
The temperature read out on the display does not correspond to the temperature measured.	PT100 is defective. PT100 has aged. Recalibrate the readout of the controller using the offset(OFSt) parameter. An offset of plus or minus 5℃ can be set to recalibrate the bath temperature reading.

9.2 Message on display

Code	What does it mean	What action to take
E61	Defect / calibration PT100	Check wiring and element. Ohmic value at 0°C=100R and at 100°C=138R. Replace PT100
E70	Error on operational parameters	
E50	EEprom error	Auto - reset after 2 s
E82	Error on input during calibration	
E4	EEprom error	Auto - reset after 2 s
E5	EEprom error	Auto - reset after 2 s
E6	Watchdog error	Auto - reset after 2 s

10 SPECIFICATION

10.1 Technical specifications overview

Item	Unit	TC16	TC40	TC58
Ordering code 230V	50 or 60Hz	**00T0671**	**00T0681**	**00T0691**
115V	50 or 60Hz	**00T0861**	**00T0851**	**00T0881**
Power	[Watt]	1600	2800	2800
Materials	Used inside bath: stainless steel 304, PTFE			
Range	Ambient .. 250°C/..482°F			
Reading	Standard °C, °F on request			
Setting ±	[°]	0.1		
Stability ±	[°K]	0.02	0.02	0.02
Heating	[W]	1200**	2700	2700
Bath volume	[L]	16	40	58
Pump	[mBar]	Max pressure 300*		
Pump	[L/min]	Max flow 7.5*		
Opening	[mm]	180 *210	420 *275	420 *275
Depth bath	[mm]	200	200	300
Length	[mm]	455	705	705
Width	[mm]	295	375	375
Height	[mm]	440	440	590
Weight	[Kg]	21	30	35
CE	Conforms to CE regulation			

* Optional pump with pressure max 1bar, flow max 16ltrs/min, reference: 24T0392. See specification sheet "pumpgraph
** Additional heater 1500W optional to heat larger loads when circualting

11 SPARE PARTS

Ordering number		Description
115V 50/60Hz	230V 50/60Hz	
25T1243	25T1242	Fan
04T0035	04T0045	Pump complete
25T1290	25T1300	Pump motor
24T8080	24T8090	Motor fuse
24T3300	24T3330	Motor Capacitor
06T0420	06T0425	PCB TE series
25T0170	25T0180	Heater 200/1000 Watts
25T0190		Boost Heater
24T8540		Mains switch
28T4106		Keypad foil
28T4107		Front sticker TC16
28T4108		Front sticker TC40
28T4109		Front sticker TC58
24T8581		Safety thermostat
28T3014		Controller PCB 115V & 230V (Not programmed, when ordering always specify bath (i.e. TC16, TC40, TC58)

12 DISCLAIMER

Information given herein is offered in good faith as accurate, but without guarantee. Conditions of use and suitability of the product for particular uses are beyond our control; all risks of use of the product are therefore assumed by the user and

We expressly disclaim all warranties of every kind and nature, including warranties of merchantability and fitness for a particular purpose in respect to the use or suitability of the product.

Nothing is intended as a recommendation for uses which infringe valid patents or as extending license under valid patents. Appropriate warnings and safe handling procedures should be provided to handlers and users. Alteration of this document is strictly prohibited. Except to the extent required by law, republication or retransmission of this document, in whole or in part, is not permitted. Tamson Instruments bv assume no responsibility for accuracy of information unless the document is the most current available. Tamson Instruments neither represent nor warrant that the format, content or product formulas contained in this document comply with the laws of any other country except the Netherlands.

Tamson Instruments bv, All rights reserved